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Correspondence of $F(R)$ gravity singularities in Jordan and Einstein frames

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ABSTRACT

We study the finite time singularity correspondence between the Jordan and Einstein frames for various $F(R)$ gravity theories. Particularly we investigate the ordinary pure $F(R)$ gravity case and the unimodular $F(R)$ gravity cases, in the absence of any matter fluids. In the ordinary $F(R)$ gravity cases, by using specific illustrative examples, we show that it is possible to have various correspondences of finite time singularities, and in some cases it is possible a singular cosmology in one frame might be non-singular in the other frame. In the unimodular $F(R)$ gravity case, the unimodular constraint is affected by the conformal transformation, so this has an effect on the metric we choose. Moreover, we study the Einstein frame counterpart theory of the unimodular $F(R)$ gravity case, and we investigate the correspondences of the singularities in the two theories by considering specific illustrative examples. Finally, a brief dynamical system analysis is performed for the vacuum unimodular $F(R)$ gravity and we

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